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ABSTRACT

Among the goals and recommendations for agriculture and natural resource education presented to the University of Wisconsin System institutions and Board of Trustees by the Steering Committee for Strategic Planning for Agriculture and Natural Resources are the following: (1) provide domestic and international leadership in research on food and agriculture, natural resource and community viability issues; (2) strengthen curricula and learning environments consistent with new and evolving concepts of agriculture and natural resources, technologies and understanding of learning; (3) provide students seeking a broad general education with curricular opportunities that reflect the rich diversity of traditional and emerging disciplines in agriculture and natural resources; (4) deliver programs of instruction in agriculture and natural resources in a manner that maximizes independent learning and provides extracurricular activities that develop leadership; (5) deliver holistic, balanced, problem solving education and lifelong learning opportunities to the citizenry in a timely manner; (6) establish a network of upper midwest public institutions with programs in agriculture and natural resources in order to improve research, extension, and instructional capacity; (7) diversify the human resources of the colleges of agriculture and natural resources by giving high priority to recruitment of women and minorities for faculty, staff, and administrative positions; and (9) recruit and retain a diverse student body. Appendixes include listings of conference presentations and data on enrollment and degrees awarded. Includes 47 references. (LPT)

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Agriculture and Natural Resource Education for 2020



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*Report of the University of Wisconsin System
Strategic Planning for Agriculture and
Natural Resources*

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AGRICULTURE AND
NATURAL RESOURCE
EDUCATION FOR 2020:

BALANCING PROFITABILITY,
ENVIRONMENTAL VIABILITY
AND SOCIAL INTEGRITY

STRATEGIC PLANNING FOR
AGRICULTURE AND
NATURAL RESOURCES

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Agriculture and Natural Resource Education for 2020: Balancing Profitability, Environmental Viability and Social Integrity

20-20 Vision!?! As the Steering Committee for Strategic Planning began to plan for the future of agriculture and natural resource education in the University of Wisconsin System, we struggled and experimented with views of how these fields will be functioning 30 years in the future. We anticipate that the world will be a very different place in the year 2020. Many of the trends which have begun to emerge will continue to be evident, but other changes may be more difficult to project.

Demands on the use of the natural resource base will almost surely increase in ways we cannot even imagine today, and principles of stewardship of resources will permeate private and public decision making. Public opinion will also continue to affect the way that producers and processors operate. The farmer, forester, aquaculturist, energy developer, community specialist, warden, and park manager will be required to blend development actions in the context of natural resource conservation and enhancement.

Scientific and technological advances have already accelerated change in agricultural production and the food, fiber and mineral industries. In a world of limited resources, it is vital that those fields which are dependant on that resource base develop practices which can maintain an adequate food and fiber supply while providing economic opportunities for the individuals and companies involved. It will become increasingly important that short term and profitability goals be balanced with long term environmental needs. Those enterprises that adapt most successfully to these changes will be competitive, and will survive.

The UW System has a significant role, in cooperation with industry, to sustain an educational environment that produces the knowledge to maintain an adequate food and fiber supply and provide economic opportunities for rural America. If it is to effectively and efficiently serve the citizens of the state and nation with limited resources, the UW System must anticipate and plan for those developments. New approaches and directions will be needed, while at the same time historic strengths of the System in agriculture production and in the social and natural sciences are preserved. Careful planning and foresight are critical. It has been said that hindsight is always 20-20. It is vital that we not look back in thirty years to see missed opportunities and wasted resources. Accelerating change makes the need for intelligent, bold response urgent. Business as usual will not be an option.

*Without an eye toward the
future, we flounder in the
present.*

Sally K. Ride
(Astronaut)

As institutions of the UW System carry out their missions within the domains of agriculture and natural resources, they should focus once again on the question John Bascom posed in 1884 when he asked: "What do members of a state university owe to the state?" The faculty also need to reinvigorate the tradition Bascom kindled, **the Wisconsin Idea**, that: "educational men [and women] ... gather influence within their own fields and ... become the servants of the state to counsel action as well as carry it out."

VISION

In a finite, interdependent, and rapidly changing world, it is imperative to maintain strong agricultural, forestry, mineral and recreation production and distribution systems, and to be good stewards of our cultural and natural heritage. Urgently needed changes must be initiated to strengthen the knowledge base for agriculture and natural resource systems. UW System colleges of agriculture and natural resources must rededicate themselves to providing leadership and service to Wisconsin as they explore new directions in agriculture and natural resources leading to the education of the citizenry and the discovery, critical analysis and transfer of knowledge beyond the boundaries of the campus.

*I don't skate to where the puck is,
I skate to where I think the puck
will be.*

Attributed to one of hockey's
most skillful players,
Wayne Gretsky

SCOPE

The University of Wisconsin System last engaged in a long range planning exercise for agriculture and natural resources in 1974. That committee report provides a baseline for examining the state of agricultural and natural resource education now and into the future.

Much has happened in these two broad areas in the intervening years, yet several themes are as germane today as then. First, students in undergraduate agriculture and natural resource programs should have a solid general education foundation, and agricultural and natural resource science should be a part of general studies programs. Second, agriculture and natural resource programs should prepare future professionals for a changing work environment and emerging career opportunities. Third, the UW System must provide a sound research infrastructure to generate new information in agriculture and natural resources. Fourth, in the spirit of the Wisconsin Idea, all faculty regardless of employment status have responsibility to transfer research knowledge to students in the classroom and to the citizens of the state and nation.

What's past is prologue.

William Shakespeare

The 1974 committee was innovative in recommending the establishment of a research and instruction consortium to facilitate research cooperation between UW-Madison and other agriculture/natural resource campuses. It also recommended that extension specialists be placed at institutions throughout the state, and that faculty on such campuses be utilized in extension roles when feasible. Some committee recommendations were not implemented, most notably a call for a standing UW System advisory committee for agriculture and natural resources. Nevertheless, that report helped chart a new course for agriculture and natural resource programs within the UW System. While issues like food distribution, world hunger, marketing, food safety and value-added product development remain current, new research and policy themes have emerged and have attracted public attention. Undergraduate and graduate enrollment in colleges of agriculture and natural resources has been volatile, with some degree programs remaining stable while many declined. Farm families and high school agricultural programs, traditional sources of students and potential faculty, have declined in number and in enrollment. Although the student population and faculty have become more diverse, they do not yet reflect the heterogeneity of the general population. The employment picture for agriculture and natural resources has fluctuated considerably since the 1974 report, but is currently very bright.

When Vice President Eugene P. Trani appointed the Steering Committee for Strategic Planning for Agriculture and Natural Resources, he asked it "to examine some of the trends in the broad areas of agriculture and natural resources and to develop a synthesis of future issues and educational needs in these areas."

The Steering Committee was charged with three tasks:

- ◆ *Identify* trends important to colleges of agriculture and natural resources and the implications of those trends for agriculture and natural resource programs in higher education;
- ◆ *Become familiar* with current programs in UW System colleges of agriculture and natural resources; and
- ◆ *Consistent* with the mission statement of the University of Wisconsin System, *recommend* how UW System institutions can respond to current and likely trends and anticipated needs.

The report is directed to the University of Wisconsin System institutions and the Board of Regents to guide their planning and commitment of resources as they work to meet the future needs for agriculture and natural resource education.

In the words of the charge,

- ◆ The Steering Committee will define goals and strategies that UW System colleges of agriculture and natural resources should use as guidelines as they chart a path for the future.

In the sentiment of the Yahara Conference,¹

- ◆ UW System colleges of agriculture and natural resources should demonstrate leadership in reaffirming the Wisconsin Idea.

The first step toward improvement is to look the facts in the face.

Oliver Wendell Holmes

The focus of this report is agriculture and natural resource education. Only those University of Wisconsin System degree granting programs in agriculture and natural resources have been visited and addressed. They are: University of Wisconsin-Madison, University of Wisconsin-Platteville, University of Wisconsin-River Falls, and University of Wisconsin-Stevens Point. Because the University of Wisconsin-Extension is inextricably linked to these programs, extension education is likewise considered. The committee recognizes that there are programs at other UW-System institutions related to the study of agriculture and natural resources. Those programs are also encouraged to strongly consider the goals and recommendations of this report.

Finding the Balance

In designing the committee work, conceptual and procedural compromises had to be reached to find a balance between the various forces, approaches and visions of the people working in agriculture and natural resources. Some committee members would have preferred that the report chart past efforts and then establish a blueprint for agriculture and natural resource education at some point in the future. Others preferred to define the parameters of change more globally and concentrate on those changes that will alter the basic concepts of education as we know it, and then to deal with the treatment of agricultural and natural resource education as it responds to those transformations. To balance those views, the committee attempted to map the responsibilities for agricultural and natural resource education by existing Colleges of Agriculture and Natural Resources while recognizing the fundamental concerns about the structure of education itself.

I am seeing an explosion of people and organizations interested in helping in rural economic development, but I am not seeing a lot of coordination. People are going in divergent directions.

Ed Meyer,
FOCUS ON THE FUTURE

Clearly change in all facets of knowledge is accelerating. By the year 2000, and certainly by the year 2020, the patterns for education are likely to be quite different from existing formulas. Sources of knowledge to be used in the future will be based in disciplines which go far beyond that which is embraced in "traditional" agricultural education. Even now, the salient contributions of business and engineering, the social sciences, and communication technology to agricultural education are expanding greatly. Indeed, it is uncertain whether agricultural curricula and institutions *as presently structured* will exist within the next few decades.



Much as a tower maintains its strength and stability with guy wires, pulling and guiding in different directions, the committee was balanced and "steered" toward a central focus by forces and tensions which helped to guide, direct and balance its work.

Against this scenario which anticipates change and uncertainty are those needs of established institutions, functions and units to maintain their capability to deliver new knowledge and trained personnel for the more immediate future. Resource commitments made to meet immediate needs should not impede necessary long-term changes.

Another area of committee discussion centered on disciplinary and interdisciplinary problem-solving capability. Agriculture and natural resource problems, both current and future, demand multi- and interdisciplinary approaches. Sometimes an interdisciplinary approach is seen as coming at the expense of disciplinary education. We view the perception of a dichotomy between interdisciplinary effort and disciplinary specialization as a false polarization. In fact, the needs for synthesis are only met by acknowledging the essential role of the traditional disciplines in generating new knowledge. Disciplinary and multidisciplinary educational approaches are complementary and merit parallel consideration. Thus in this report, as we address multi/interdisciplinary opportunities, we also recognize the need to strengthen relevant agricultural and natural resource disciplines that will surely impact such areas as food, biotechnology and sustainable development.

Finally, while cognizant of the essential global requirements for agriculture and the environment, issues of a more local nature could not be ignored. Therefore the committee attempted to think globally while acting locally to set the agenda for agricultural/natural resource education for Wisconsin.



A CALL FOR ACTION

The recommendations contained within this report argue for a renewed commitment to agricultural and natural resource education. In particular, a call for action is recommended that would:

1. Undertake a facilities modernization program for research and instruction in agricultural and natural resources programs. It is imperative and urgent to incorporate the latest knowledge in laboratory and instructional programs on all campuses and to sustain a premier research capacity on the Madison campus.
2. Increase the quality of scientific expertise in basic science, agriculture production, processing and marketing, biotechnology, forestry, wildlife sciences, and air, soil and water resources protection and management.
3. Provide urgently needed professional growth and development opportunities for all faculty. Such faculty development opportunities should include, but not be limited to, sabbaticals and faculty exchanges among campuses.
4. Define, facilitate and fund the undertaking of high priority research in agriculture and natural resources.
5. Establish collaborative exchanges within the System and with research institutions in other states to efficiently utilize resources and conduct research in agriculture and natural resources.
6. Help Wisconsin businesses and citizens cope with the major economic, social, and life style changes related to agriculture and natural resources. To reaffirm the Wisconsin Idea, UW-Extension and the campuses must work together, utilizing available and emerging technologies, to provide outreach education to the people of the state.
7. Evaluate the agriculture/natural resources curriculum, extension, and research programs to maintain strengths and to ensure the implementation of material on global trends and the integration of current information for agriculture and natural resources education.
8. Encourage the creation of administrative structures that facilitate interdisciplinary and inter-campus research, instruction and extension programs on broad public issues.
9. Establish a review process to assess organizational overlap, functional duplication, and the lack of coordination between similar programs. The committee, therefore, urges the UW-System to undertake a systematic re-evaluation of the overall structure and framework of the current educational delivery system for agriculture and natural resources to ensure that it constitutes the most effective configuration of human and financial resources possible.

To accomplish these goals, it is imperative that the state of Wisconsin provide the necessary support and funding.

Agriculture, Natural Resources, and the Environment

11

The Global Condition

The environment is a complex web of interconnecting ecosystems and human activity. Economic activity is of special interest within this web. Recently, it has become clear that local economic activity can affect ecosystems both regionally and globally. Similarly, a local ecosystem is affected by activities happening in other parts of the region or the world. In the words of the World Commission on Environment and Development (Brundtland and others, 1987), "We are now forced to accustom ourselves to an accelerating ecological interdependence among nations. Ecology and economy are becoming ever more interwoven — locally, regionally, nationally, and globally — into a seamless net of cause and effect." Therefore as we close the century, it is clear that natural resource concerns are important issues that establish the context for and will substantially influence Wisconsin agriculture from now to the year 2020.²

The state of the global ecosystem is central to maintaining production systems. People use natural resources and consume agricultural products. More people require more resources, thus population growth is one basic driving force in global environmental issues. Since their population is growing at a faster rate, Third World countries will comprise an increasing proportion of the world population. With more demand placed on diminishing resources and limited financial resources to protect the environment and respond to pollution problems, decisions made in less developed countries play an important part in the state of the global ecosystem. However, industrial and industrializing countries, through their high consumption, may have the greater consequence for the global resource base. Unless developed countries use their knowledge and wealth to balance consumption with resource management, the global ecosystem will remain in jeopardy.

Changes in the chemistry of the atmosphere affect vegetation, soil, and water. The implications of atmospheric changes are unknown, though the effects of some of these changes are thought to be potentially great. For example, without a significant reduction in nitrogen oxide and sulfur dioxide emissions, acid deposition could impact agriculture, forests, fisheries, lakes, rivers, and human health. Global climate change could alter local weather patterns and sea levels, and thus produce shifts in agriculture production among different domestic and international regions.

The biosphere also warns of serious problems. Species reduction could limit the source of genetic material for improving strains of common food crops, the source for development of "new" crop strains, and the source of active ingredients for about 40 percent of prescription drugs on the market today.

*We cannot afford ignorance of the
world in which we live.*

Karl Brandt
Curricular Innovation for 2005

While the world cries out for more food, fiber and wood, excessive cropping, grazing and deforestation already are causing the most rapid desertification, soil erosion, wetlands destruction, ground-water depletion and species extinction in history.

Russell W. Peterson

Many global environmental concerns — deforestation, desertification, and loss of productive land and critical ecosystems — are ultimately land use issues. Land use is central to many global environmental issues because decisions are often virtually irreversible and their repercussions felt both locally and globally. Reconciliation of competing demands for the preservation of critical ecosystems and their development for land uses supporting economic activity is a major concern for scientific study and public debate. Land stewardship and identification of uses that do not exhaust the productive capacity of different types of land are related concerns. Natural beauty and the attractiveness of the landscape also help to define the quality of life for Wisconsin citizens, seasonal residents and tourists.

The energy issue today, and into the future, is the transition to the next generation of energy supplies beyond fossil fuels. Future sources of energy have implications for natural resource management affecting renewable energy sources. This has significant implications for agriculture since energy is a major agricultural input and some agricultural products and by-products are potential sources of energy. Changes in energy sources affect agricultural practices, agrichemical production and distribution, and food processing and distribution.

In the past twenty years, a growing awareness of the adverse effects of many by-products of human activity has resulted in a call to control the discharge of conventional pollutants into the air and water, and the disposal of solid wastes on the land. Toxic and hazardous waste management adds new dimensions to air and water management and emphasizes the critical nature of residuals management, including recycling and source reduction. The technology to store, manage, and dispose of these wastes is costly and sophisticated. Detection and remediation are beyond the capacity of most localities. Given the amount of resources necessary to properly manage toxic and hazardous materials, waste management and disposal will continue to be major issues at all levels from local to global.

Side effects of food production is another environmental issue of the 1990s and beyond. Major public health and policy issues include contamination of groundwater by nutrients and pesticides, pollution of surface water with sediment and chemicals, and hazards that pesticides and other agricultural chemicals may pose to the health of farmers, consumers and wildlife.

Agriculture must play a central role in the environmental discussions. U.S. agriculture is envied throughout the world for its ability to improve productive capacity and provide a quality and wholesome food supply for an ever expanding world economy. While agriculture has an obligation to provide food and fiber for the growing world population, that obligation must be met in a manner that does not deplete or destroy the natural resource base on which it rests.

Like forestry, fisheries, mining, and tourism, agriculture can no longer pursue a resource policy in isolation. Vital systemic relationships exist between primary resource production processes and resource protection.

In sum, healthy lands, water, forests, wildlife, fisheries and communities are essential to agricultural production and resource conservation. These resources form the framework around which rural life has evolved. The people who farm the land, harvest the forests, and enjoy the bounty of nature are actors in a dynamic, global ecosystem, subject to the social and biological forces which regulate these systems.

The words that follow attempt to capture the uncertainty, challenge, and excitement of a bright new era for agriculture and natural resource programs.

Agriculture in a Global Context

Agriculture and food production became an integral part of a dynamic world economy during the Twentieth Century. Worldwide application of agricultural research, science and technology brought self sufficiency, adequate diets and improved nutrition to many nations. Unfortunately, severe food production and distribution problems still plague many countries. Current food shortages and distribution problems in Africa, Eastern Europe, Latin America and the Soviet Union, amplify the critical need for expanded agricultural research, education and development.

The development of global commodity markets has had a significant impact on the market structure of U.S. Agriculture. The internationalization of the U.S. food system has occurred rapidly in the food manufacturing and food retailing industries. Most of the large U.S. food marketing companies are multi-national firms closely linked to

We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.

Aldo Leopold

The link between US agriculture and the global economy is not new. Since colonial times, US agriculture has needed the international market for its livelihood. But as world market growth and US productivity increased in the last two decades, the nature of the US dependence on the global economy has changed. . . By 1980, almost 40 percent of US cropland was planted for export.

M. Ann Tutwiler

With the collapse of the system of fixed exchange rates, the rise in oil prices, and the development of the Eurocurrency market, the world became one huge capital supermarket. Farmers in Topeka had to compete with car makers in Tokyo for funds.

M. Ann Tutwiler

key trading centers in Europe, Asia and South America. The industrialization of the U.S. food system requires favorable trade negotiations and foreign policy to provide open access to international markets. The viability and profitability of the American farmer is often directly related to agreements and concessions in the General Agreement on Tariff and Trade (GATT) negotiations, world monetary policy and the stability of foreign governments.

Food production and agricultural trade will remain a significant part of the world economy in the 21st century. Population expansion, improved nutrition, growing affluence, changing demand and the domestic food policies of many countries will continue to produce rapid changes in prices and demand for U.S. food production.

Technological advances in biotechnology, genetics, integrated pest management and food technology will help ensure a viable food production system. Scientists will be challenged to explore new frontiers of knowledge and develop new technologies to provide the productive capacity needed by a global society.

The dynamic changes in agriculture are not only technological and economic but social and cultural as well. In 1989, academic and industrial leaders of the National Research Council urged that the definition of agriculture be broadened beyond the system that grows, processes and distributes food and fiber to "also encompass the related natural resource industries, public policy issues, social systems and physical and biological environments". Structural changes in the global economy will continue to reshape all sectors of the U.S. economy including non-metropolitan communities and the agriculture and natural resources industries on which they depend. This dependency of rural areas on goods-producing industries like agriculture and forestry will increase the ties between many non-metropolitan counties and the global market place.

The growing interdependence of the world economic community has also brought new challenges and opportunities to agricultural colleges and universities. Highly trained graduates with knowledge and understanding of international markets and with multi- and bi-lingual skills will be in strong demand. International research will require students capable of interpreting cultural differences, socioeconomic policy and geographic data. Scientific breakthroughs will accelerate as the research and educational communities focus on common objectives and basic needs.

American agriculture will continue to play a significant role in the world market economy in the next thirty years. U.S. Agribusiness is the world's largest commercial industry with over a trillion dollars in assets and 20 percent of the national work

force. The total number of harvested acres has remained constant over recent decades, but the actual number of farms has declined sharply. About 15 to 20 percent of the commercial farms produce over 80 percent of the national food supply, while three-fourths of the farm households now have supplemental off-farm income.

Wisconsin's Agriculture Today and Tomorrow

National data often mask regional variations. In the Wisconsin-Minnesota dairy industry a relatively small proportion of milk production comes from very large commercial farms. The farm population here is generally more dependent on farm income than in many parts of the country, and fewer than 30 percent of the farmers hold part time jobs. In Wisconsin, there has been a growing trend to multifamily farms with greater acreage and larger herds.

Agriculture and food processing, distribution and retailing provide a significant source of employment and income in nearly every community in the state. Commercial farming is a major industry, producing over \$5 billion annually in cash farm receipts and providing the raw products for Wisconsin's extensive food processing industry. Nearly 85 percent of the state's agricultural products are consumed outside the state, with significant amounts of commodities and services marketed in international trade. Dairying is the state's major agricultural industry, but Wisconsin is also a leading provider of many vegetable crops that are processed in the state and marketed domestically and for export. Both producers and processors are considering an array of alternative vegetable crops and fruits to meet changing consumer demands.

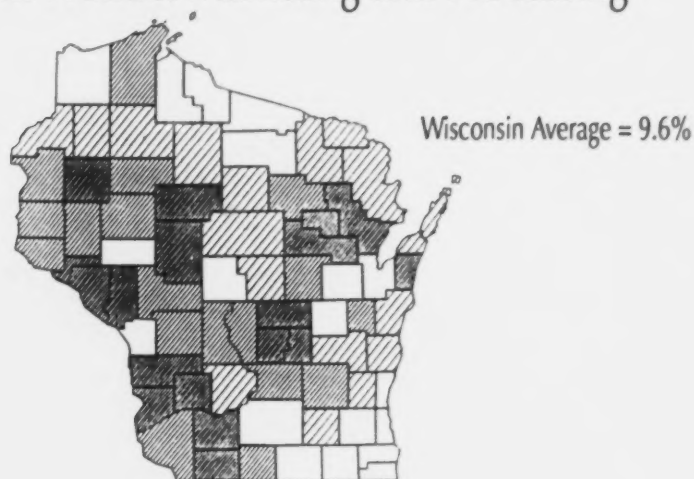
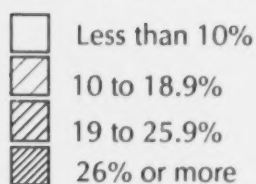
The critical challenge for Wisconsin agriculture in the next few decades is to stay competitive in national and world markets. Meeting that challenge will necessitate balancing efficiency and profitability with environmental integrity. Global environmental and economic trends underscore the rapid rate of change and the scope and complexity of factors producing change. Six major factors will shape the trends. They are:

1. the continued development of global capital and product markets;
2. the content and degree of coordination of economic, social, and food policy worldwide;

Virtually nothing is as it was for U.S. agriculture. Exports contribute a significant portion of farm income; prices of inputs are determined in the world market; U.S. markets are more diverse and more unstable; U.S. farmers compete with foreign governments as well as foreign farmers.

M. Ann Tutwiler

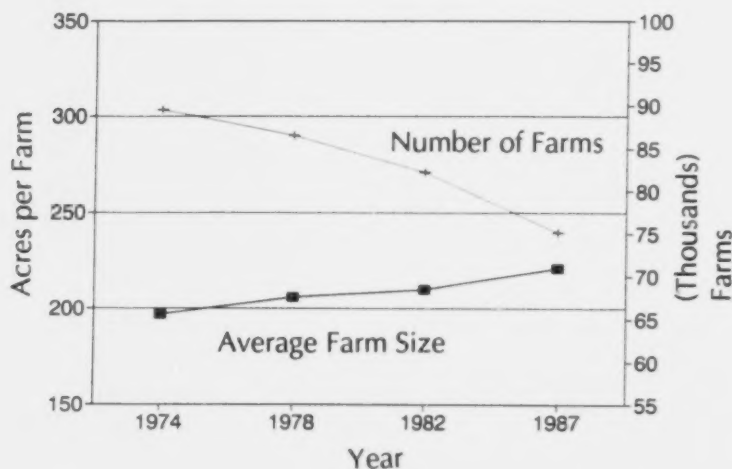
Percent of All Wisconsin Jobs in Farming Farm Inputs and Services, and Farm Product Marketing and Processing



Source: Analysis of U.S. Census Bureau "County Business Patterns" data.
University of Wisconsin-Extension Cooperative Extension, 1987

Number and Average per Farm Area of Wisconsin Farms

The U. S. Census Bureau defines a farm as a place from which \$1000 or more of agricultural products were sold (or normally would have been sold) during the year. The definition remained constant from 1974 through 1987.



Source: U.S. Department of Commerce, Census of Agriculture, 1974, 1978, 1982, 1987
University of Wisconsin-Extension Cooperative Extension

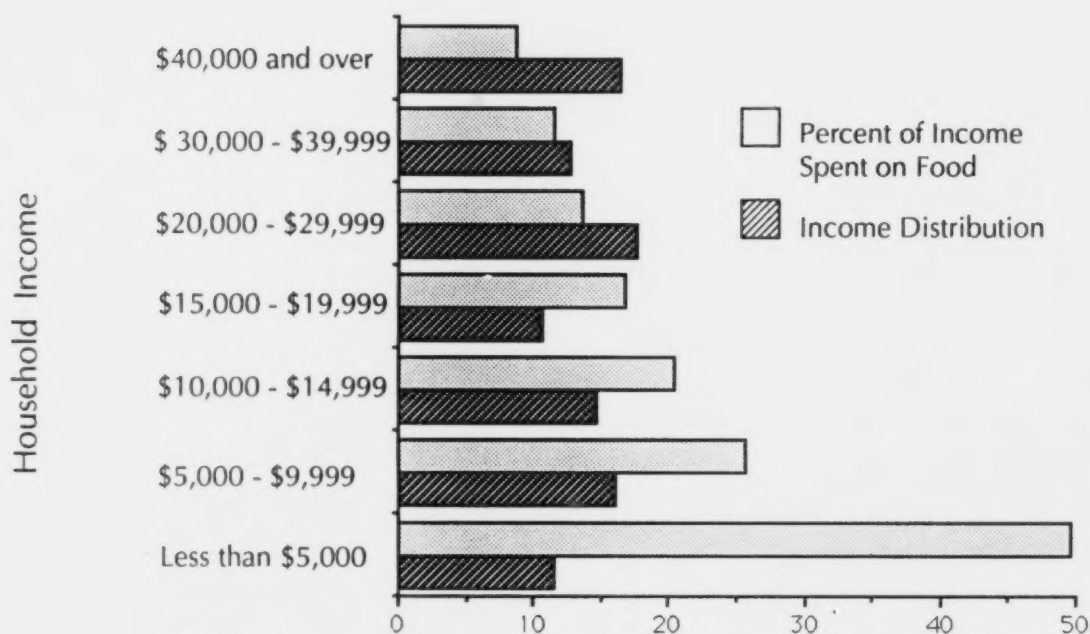
3. the emergence of mega markets, like the European Economic Community and the Pacific Rim, and the breakdown of market barriers;
4. population growth and population shifts;
5. the impact of global climate change, droughts and floods;
6. and the growth of biotechnology and the explosion of technical and scientific knowledge generally.

Within this context, some of the specific challenges and opportunities facing the agricultural community in the next few decades are: developing new national and international markets for our products and new products for international markets; strengthening and increasing cooperative marketing; upgrading food processing plants by adapting new food engineering technology; increasing agricultural input options and input systems that protect and enhance soil, water, and other fragile resources; helping producers and processors develop superior business management and technical skills; assisting the food industry to develop ways to compensate for Wisconsin's location and climate; developing and transferring information and new technology related to production, processing, and marketing; expanding technology transfer to emerging service sector occupations ranging from crop consultants, tree disease specialists, and licensed chemical operators to food servers in the fast food industry; and developing policy options that will encourage profitable production while maintaining a safe environment and meeting demands for high quality, safe, and nutritious food.

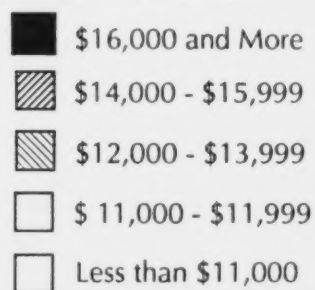
Sustainability is the desire for an assured economic and cultural future. It doesn't mean doing the same thing over infinitely, it means having the materials and processes needed to change with the times and sustain the species.

John C. Gordon

Income Distribution of U. S. Households, and Percent of Household Income Spent on Food by Income Level



Per Capita Personal Income



Sources: U. S. Census Bureau, DOA Projections, 1986 & 1988
 University of Wisconsin-Extension Cooperative Extension

Food Safety and Human Nutrition

Although the United States food supply is among the safest in the world, public concern about food hazards has risen dramatically in recent years. New technologies may increase production efficiency and reduce producer risk, but also give rise to consumer concerns about harmful residues in food and changes in food properties. New processing and marketing technologies can enhance food quality, shelf life and consumer convenience, but also may increase the possibility of food safety problems. Biotechnologies aimed at improving food production and processing are of particular public concern. At the same time, sophisticated instruments have greatly increased the ability to detect pesticides, chemical residues, toxins and harmful microbes in food.

Added to this rapidly changing food safety scene are numerous activist groups and organizations that have found new ways to bring food hazards to public attention. Increased activism has led to demands for new public policies to protect consumers from such perceived hazards. Neither policy demands nor perceived risk can be ignored. While new technologies can improve detection of risks to public health, improvements in the communication of risk information to decision makers and the public can inform public policy development. A new outreach role is being formed around human nutrition directed at new clientele, ranging from those interested in physical fitness to those who serve prepared foods, as the public relies increasingly on fast foods from restaurants, delicatessens, convenience stores and other vendors.

The Twenty First Century will see no let up in consumer demand for improvements in food quality and convenience. Changes in lifestyle, family structure, and the ethnic and cultural composition of the U.S. population will continue to have an impact on dietary needs and food product demand. Dual-income and single person households will increase the demand for good tasting, nutritious food that is easy to prepare or readily available.

On the nutrition side, American consumers have more information on healthy eating habits available for their use than ever before. Yet, these consumers remain susceptible to dietary fads, and surveys suggest that the public lacks an understanding of the role of food in human health. Additional effort will need to be devoted to convey nutrition information to the public, and attention must be focused on the barriers which inhibit individuals from acting on that knowledge. Research is

In the 1930's crop yields in the United States, England, India, and Argentina were essentially the same. Since that time, researchers, scientists, and a host of federal policies have helped U.S. farmers dramatically increase yields of corn, wheat, soybeans, cotton, and most other major commodities. Today, fewer farmers feed more people than ever before.

National Research Council
ALTERNATIVE AGRICULTURE

Consumers are, in general much more risk averse than regulators or polluters. Politicians are the only important group in society that are generally more risk averse than consumers, which goes a long way toward explaining the current crisis we face in public decision making.

Charles Benbrook

underway that will increase understanding of the relationship of diet to general health, longevity and chronic disease. Specific diets are being developed to meet health needs of particular age, gender and disease groups. The need to provide adequate nutrition to the growing stratum of economically disadvantaged, especially children, will be a major challenge. Fitness and prevention of health problems will encourage continued attention on the nutritional value of foods (e.g., calorie content, cholesterol, types of lipids, sugar, salt).

Overall, food quality is likely to continue to improve. Biotechnology offers the prospect of genetically engineered plants and animals with increased disease resistance, faster growth, greater productivity, and the possibility of altering other plant traits that can improve the nutritive value of foods. Genetically engineered enzymes for more effective food processing, synthetic and reshaped foods (e.g., leaner pigs, low cholesterol eggs), new and/or improved food ingredients, and gene probes to detect food pathogens such as *Salmonella* and *Listeria* are other possible contributions of biotechnology. New analytical methodology can enhance the ability to detect small concentrations of specific substances in food and the environment, broaden the range of substances that can be detected, and identify new types of food spoilage. As it will be impossible to create a totally risk-free environment, the technologies for detection must be coupled with increased attention to risk assessment.

Ability to detect new substances can lead to changes in food processing, handling, packaging and preparation. New food packaging and packaging materials are likely to be developed that will permit food to be microwaved without the migration of materials from package to food. With such technologies, safe consumer handling and preparation of foods will continue as major food issues of the future.

Food safety has increasingly important economic consequences. With greater consumption of food outside the home and with more convenience foods purchased in prepared form for in-home eating, consumers are able to change their demand for food much faster than in earlier decades. Thus, any actual or perceived problems in food safety, combined with current media capabilities, can have a large and immediate impact on the demand for a food commodity with severe economic consequences on a portion of agricultural producers and rural communities.

Natural Resources and the Land Ethic

There is increasing awareness that natural resources undergird our most basic production practices in agriculture, forestry, fisheries, wildlife and water resource management, and energy and mineral development from the local to the global level. In recent decades, recreation, tourism, and aesthetic vistas have been included as natural resources requiring management. Airsheds have been added to watersheds as contemporary natural resources that may well influence global climate change, agriculture, forestry and mineral production practices, urban and rural communities, and human settlement patterns in the future.

The management of these natural resources for human welfare has become a driving force in public policy (e.g., Clean Air Act, Clean Water Act, Food Security Act, concerns about global species diversity). Environmental stewardship and resource conservation are central themes.

Both consumptive and non-consumptive natural resource uses are of immense economic importance to Wisconsin. The forest products industry, led by paper, employs about 77,000 workers who convert \$67 million worth of trees and recycled fiber into shipments worth over \$10 billion annually. The mining industry sells \$232 million worth of raw materials annually to be converted into numerous final products.

The tourism industry, fragmented into a multitude of activities and services that are provided by numerous small businesses, includes about 100,000 jobs and has \$4.5 billion of economic impact per year. Sport fishing involves 1.8 million anglers who spend \$712 million and generate another \$1.2 billion in annual business activity. Over 700,000 hunters spend \$311 million while 3 million non-consumptive users of wildlife spend \$338 million per year. Separate economic impact figures are not available for other non-consumptive uses such as auto touring, bicycling, boating, camping and skiing, but marinas on the Great Lakes, for example, generate \$84 million per year.

The magnitude and diversity of natural resource industries have further escalated resource policy questions and refined the resource policy process. While new natural resources may continue to be discovered, the diverse and conflicting demands for existing resources will dominate resource management over the next

Hard changes are in store for forestry and environmental academia, including growth, movement away from disciplinary and commodity focus toward problem solving politically and socially defined problems, and movement toward integrative research and teaching on a scale rarely contemplated now.

John C. Gordon

Forest Industry Employment

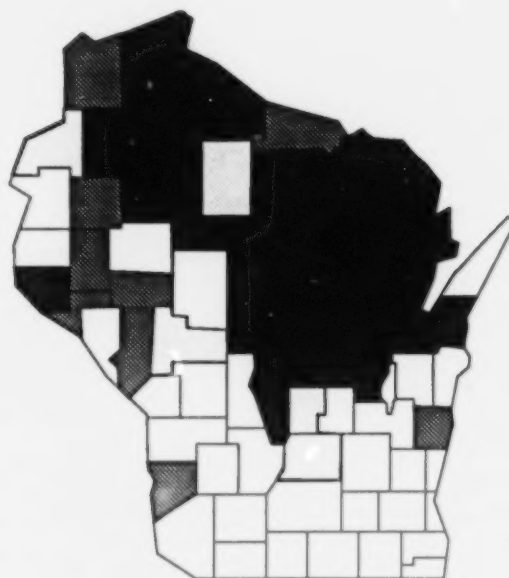
■ #1 Employer
(28 Counties)

■ #2 Employer
(9 Counties)

□ #3 Employer
(5 Counties)

76,000 employed in primary
forest industries
200,000 employed in secondary
industries
7,000 employed in logging
and hauling

283,000 employed in total

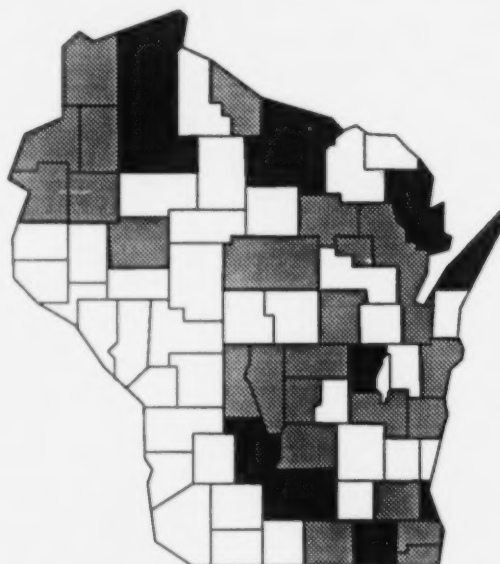


Source: Wisconsin Department of Development, 1985

Recreation/Tourism Centers

■ Tier 1 (the 11 counties whose total rankings placed them in the top one-sixth of the state. These counties are considered to be the most important tourism centers in Wisconsin.)

■ Tier 2 (the next one-third of the state's counties in the tourism rankings. These 24 counties showed relatively strong characteristics of a tourism economy.)



Source: Wisconsin Department of Transportation, 1989

30 years. The major trends and issues noted here reflect the debate about the "choice among alternatives" that requires a delicate balancing of economic development and natural resource conservation considerations.

The policy struggle with regulations regarding export of raw materials and value-added processing will escalate as production sectors become distributed throughout various world economies. Forest resource production and marketing operations will concentrate on competitive advantage and considerations for alternative uses of resources in the context of water quality, tourism and wildlife and fish habitat. Ecosystem management principles for both the private and public land manager will become standard operating procedures. The unit of analysis will shift from field, farm and forest to a macro landscape system.

Similarly, non-consumptive use of forest and other natural resources will increase. Both recreational and urban forests will grow in number and importance for public land management agencies. Aesthetics, catch and release fisheries and non-game wildlife programs will dominate recreational thinking, activities and management.

With greater diversity in expectations from a limited resource base and from participants in tourism and recreation activities, conflicts over resource management will accelerate. Debates on the purpose of public forests, surface water use and the recent Indian treaty rights issues are examples of current resource use conflicts. Discussions will continue between proponents of individual and collective rights and advocates for the public good. Specialized and exclusive recreational uses; motorized recreation/high technology equipment; noise and litter; lack of stewardship by landowners; short-term perspective of investors; and national versus global benefits are some of the most likely topics of conflict.

The degree of government regulation of private property and business in the areas of land use planning/zoning; billboard control; waste management and treatment and waste load allocations of pollutants; impact of regulations on small businesses; and biotechnology in forestry and wildlife will be debated seriously.

Institutional arrangements will be developed to internalize the costs and benefits from the use of natural resources such as wildlife damage to agriculture and conversely agricultural damage to wildlife. Integration of the aesthetic and ecotourism benefits from pastoral landscapes and wild areas with other resource uses will be supported by agency regulations and programs.

Increasingly it is seen that environment and economic development are positively connected. Environmentally livable places attract productive people and modern industry. Perhaps the central challenge for natural resources people in academia and out, is to move their expertise to where the action is: economic development of an environmentally benign kind, in a society managed for change.

John C. Gordon

We have a marvelous opportunity before us. We can take the strong elements from natural resources and blend them with other areas of knowledge and create a new profession . . . because environmental management is a component of every human endeavor, they [environmental managers] may become as plentiful as MBA's or even lawyers.

John C. Gordon

For the first time in U.S. history, rural and agriculture are no longer synonymous.

Ronald Knutson &
Dennis Fisher
FOCUS ON THE FUTURE

Finally, questions of philosophy and ethics will be dealt with more directly by the universities, management agencies, private businesses and the citizenry. Focused clientele relationships will become more holistic and long-term. A philosophy of responsibility for future human generations to non-human members of the biosphere and the air, water and soil—the land ethic—will be more clearly articulated.

Rural People, Communities and Quality of Life

Rural America is diverse. Its communities show great variation in sources of employment and income. Farming, forestry and mining are the heart of many rural community economies, but they are generally declining in importance. Employment in manufacturing, construction, tourism and other services, and income from transfer payments, interest, dividends and rent provide the major sources of personal income in many non-metropolitan counties. Rural America, like our modern cities, has pockets of prosperity and poverty.

Rural Wisconsin residents make up 30 percent of the state population. They derive their income from manufacturing, tourism, retail and service businesses, agriculture and forestry. Rural Wisconsin, viewed across communities, is extremely diverse in terms of culture and income sources. Rural communities have been hit hard by structural changes in the world economy. Greater dependency among economies links non-metropolitan America to the health of agricultural exports and factors such as international capital markets, food policies in other countries and the manufacturing market. The diffusion of technology allows nations with less skilled and less costly labor to undertake production of standardized goods in a more cost efficient manner. This puts the United States at a cost disadvantage and many of these manufacturing jobs are moving to other shores. Communications technology and the containerization revolution in transportation will continue to allow the production process to be fragmented and small nations to specialize in components that are then brought together from different parts of the world to one point where they are assembled.

Hence, many of our rural communities are at a disadvantage. The fortunes of rural areas, that showed significant improvement in the 1970s, took a turn for the worse in the 1980s. While growing slightly faster than urban areas, population growth in rural Wisconsin hovered at 2.9 percent, but has slowed. Employment growth has been less than one third that of urban areas. The unemployment rate is higher in rural areas—a reversal of conditions during the 1970s. In 1986, the average urban unemployment rate stood at 5.8 percent, while the rural unemployment rate was 7.2 percent. That same year the average Wisconsin rural resident received \$2,500 less than the average U.S. per capita income, while the average Wisconsin urban per capita income exceeded the national average by \$300 (Wisconsin Department of Development, 1988).

Educational attainment is lower, more housing is substandard, fiscal capacity of local governments is lower, and the poverty rate is higher in non-metropolitan areas than in metropolitan areas. The gap between the standard of living of rural and urban residents has grown during the recovery and expansion phases of the current business cycle.

Higher education can make a difference in rural Wisconsin. It can help diversify and expand the economic base; assist citizens to optimize output from current resources; produce and make available knowledge to improve rural conditions; advise in changing the existing organizational framework (infrastructure and delivery systems) to improve performance of basic institutions (e.g., local government, school systems); instill a desire/urge to change; develop a cultural environment that allows for discussion and debate; and tap the significant unused potential for leadership among the highly trained women in rural areas.

Solving the problems of rural communities requires a broad, comprehensive strategy. The problems of rural America are sufficiently complex that the current combination of programs has not been effective.

Ronald Knutson
& Dennis Fisher
FOCUS ON THE FUTURE

Summary

Without a doubt, agriculture and natural resources have entered a new era. Their context shifts rapidly and sometimes in unpredictable ways. Human capital for agriculture and natural resource sciences and programs is also in transition. The next three decades will find a workplace and work force that differ significantly from the past.

The challenge to Wisconsin's educational system is clear. The university of tomorrow will find more professional women and minorities occupying faculty roles and helping to redefine academic affairs. According to one estimate, academic recruitment between 1990-2004 will require 335,000 new faculty members representing the social, biological and physical sciences, arts, and humanities (Creswell and others, 1990). This will lead to a new university as we enter the twenty-first century. Similarly, agriculture and natural resource production, marketing and distribution occupations in the private sector will rely on more women and minorities. The tensions between the shortage of work force participants and skilled workers with a mastery of emerging technologies and the introduction of increased numbers of women and minorities in the workplace will dominate management thinking throughout the decade.

It is increasingly apparent that we can no longer speak of land and resource management issues as if they were or could be separated from international economic, social, political and environmental pressures and constraints. Indeed, the globalization of the economy and the biosphere are among the most powerful realities with which any exercise in strategic planning must contend.

Mark B. Lapping

The implementation of the following goals and recommendations will result in stronger and more diverse agriculture and natural resource sectors to open the new century.

Universities have an obligation to provide leadership for the changes which have been outlined. Inquiry into questions of production efficiency, profitability, technology, product safety, social viability and ecological sustainability, as well as the balance among these issues must be conducted. Through their research, teaching and extension activities, faculty and staff involved in agricultural and natural resources programs in the UW System are committed to framing and studying these challenging questions basic to the welfare of the state's current and future generations.

To allow the UW System to respond to the needs and changes anticipated in this report, the Strategic Planning Committee in Agriculture and Natural Resources presents the following goals and recommendations. Although the Committee has established a long-range vision for agriculture and natural resource education, the goals have been designed for immediate implementation, with the understanding that evaluation would be on-going. This will ensure that the educational structures would continue to respond to problems as they occur, while developing the resources and flexibility to effectively meet the challenges of the future.

In Wonderland, Alice asks the Cheshire Cat for directions: "Would you tell me, please, which way I ought to go from here? That depends a good deal on where you want to get to," says the cat. "I don't much care where. . . ." said Alice. "Then it doesn't matter which way you go," says the cat.

Lewis B. Carroll

Provide the Knowledge Base to Accommodate Rapid Change

Strategies

Research and education must discern where society is going and be there ahead to meet it. They can do this through leadership or prescience or some combination . . . What will universities do? Will they choose an effective combination of leadership and vision? Or will they miss the meeting?

John C. Gordon

Commitment to provide intellectual and scientific leadership:

- a) to improve the economic viability of the food, fiber, forest and recreation systems;
- b) to protect, conserve and enhance natural resources of the state, nation and world;
- c) to sustain production efficiency in balance with stewardship of natural resources and maintenance of a safe food supply; and
- d) to support healthy families and livable communities.

◆ Recommendation 1.1 Provide Leadership in Worldwide Research

Provide domestic and international leadership in research on food and agriculture, natural resource and community viability issues.

Research and education are basic to intellectual leadership. The historic Wisconsin Idea has been to do research in service to the people and extend it to the boundaries of the state and beyond. It is the teacher-scholar who expands minds, instills a quest for knowledge and creates the unique learning culture for the entire state. Teaching and extension are informed by research and in turn inform research.

If it is to serve society, the research process must span a spectrum of activity from basic to applied science. Research in the basic sciences is the long-term driving force of the system, but that base has been eroding. A renewed commitment to basic research is required to keep the System competitive in the biological and social sciences. Of equal concern, applied research and outreach mechanisms have not kept pace with state, national, or international needs.

The UW System must maintain excellent researchers by:

- a) hiring and retaining the best scientific talent for high priority new and existing research areas, while phasing out areas of lower priority;
- b) maintaining and rewarding scientific currency through career development opportunities for every active scholar in the System, with special attention given to faculty with limited or no formal research appointments; and
- c) promoting and rewarding linkage among the campuses within the system among faculty in allied disciplines, utilizing especially the strong research base on the doctoral campuses.

The UW System must make adequate facilities and equipment available to its researchers in cost effective ways by:

- a) seeking innovative ways to procure and maintain state-of-the-art laboratories, field sites and equipment by private- or public-sector partnerships, and
- b) forming state, regional or national consortia in some fields.

The research system is constrained by adequacy of personnel, infrastructure and financial support. Maintaining support essential for scientific competence will become increasingly difficult and expensive. Meaningful participation in research requires that sufficient time be made available for that pursuit. Scientists must have access to the latest information by direct contact with colleagues within and outside the system, adequate library based information, and personal contacts through interpersonal exchanges such as scientific meetings. Additional support for significant research and professional interaction must be provided.

Laboratories, experimental field sites and operating farms, and the equipment needed in modern science are becoming increasingly difficult and

Agricultural research priorities are shifting from simply increasing production to other areas, such as enhanced competitiveness, food safety, improved nutritional quality, new uses for agricultural commodities, and environmental stewardship.

National Initiative
for Agricultural Research

expensive for the university system to buy and maintain. The unavailability of many expensive equipment items will increasingly limit the scope and quality of research and the accompanying training of graduate-level students. Deficiencies in facilities must be confronted and remedied. Innovative ways must be found to modernize laboratories and experimental field areas if university researchers are to bring contemporary quality scientific inquiry to their institutions. Difficult, complex decisions must be made by the Board of Regents about the desirability and affordability of attempting to achieve enhanced levels of research capabilities on all or an expanded number of campuses within the UW System.

◆ **Recommendation 1.2 Facilitate Basic, Applied and Interdisciplinary Research**

Maintain excellence along the basic-applied science spectrum.

To accomplish the commitment to intellectual and scientific leadership, the UW System research program must maintain excellence in critical areas to ensure the ultimate use of research findings to solve problems or create opportunities by:

- a) maintaining the present strong base of individual, discipline-based research;
- b) facilitating and developing multidisciplinary and problem-focused research, without loss of academic freedom, initiative, responsibility or accountability;
- c) improving transfer of scientific, technological and policy findings to the class room, to the citizens of the state, and to Wisconsin's economic community; and
- d) recognizing the increasingly inter-dependent nature of the world's agricultural and natural resources.

The most effective way to ensure a strong U.S. agricultural system is to capitalize on science and technology by investing strongly in agricultural, food, and environmental research.

Natural Research Council
INVESTING IN RESEARCH

Research itself is an interactive system encompassing a spectrum of operational levels from basic sciences at one extreme, to adaptation and applica-

tion at the other. There must be a constant flow of information along this continuum between basic and applied science, and the ultimate incorporation of findings into general use and practice in both public and private sectors. Knowledge within the scientific discipline must be advanced, and the public welfare and economic development of the state benefited.

One of the major challenges facing academic research over the next three decades will be the development of increasing flexibility in the conduct of research. The single faculty investigator research system based on individuals winning competitive grants has worked extraordinarily well on the UW-Madison campus; it must continue. But alternative modes of research and sources of funding must also be found.

Research needed to define and solve many of the problems in agriculture and natural resources requires expertise in a variety of social, biological, and physical science disciplines working collaboratively. Indeed, collaborative networks may span beyond the college and the campus. Mechanisms must be developed to recognize complex research problems and assemble interdisciplinary research teams to address them. It is reasonable for the state to support interdisciplinary approaches that deal with state problems of high priority. The faculty incentive and reward system must have sufficient flexibility to accommodate interdisciplinary research.

Problems impacting agriculture and natural resources are not confined within national borders. Environmental deterioration anywhere affects the whole planet. The forces that drive ecological degradation are complex, involving social, economic and political elements in addition to the obvious biologic and physical factors that are operating. Approaches to agricultural development and natural resource management that are not broadly interdisciplinary are doomed to failure. Developing countries will require research collaboration from our scientists to preserve their food and natural resource base, and to design alternative institutions and policies. Scientific assistance may well be the greatest contribution that we can make to the stability and improvement of life in these countries, and yet the proportion of university scientists with international experience is rapidly declining. Junior faculty are often actively discouraged from international involvement by their senior colleagues. We must accept the responsibility to help reverse these trends, through a greater effort to internationalize university research.

Increasing public awareness of the interdependence of our forests and global environmental issues will require greater participation of forest scientists in local, national and even global policy making. . . not only is more research necessary, but more effective ways to transfer this information to policy makers is required.

FORESTRY RESEARCH:
A MANDATE FOR CHANGE

Prepare Students for Leadership in Traditional and Emerging Professions and as Educated Citizens

Strategies

Commitment to strengthen curricula and learning environments consistent with new and evolving concepts of agriculture and natural resources, technologies and understanding of learning.

To sustain a leadership position, UW System colleges must offer and maintain curricula that reflect both rapidly changing technology and broader concepts of agriculture and natural resources, and a curricular planning process flexible enough to keep it current.

Maintaining a margin of excellence for its undergraduate and graduate students in agriculture and natural resources can be done by:

- a) expanding curricula to incorporate new areas and more encompassing concepts;
- b) delivering curricula in a manner that generates value questions and fosters a range of skills, yet enables students from varying levels of experience at entry to meet program goals;
- c) providing opportunities for independent learning and leadership development;
- d) recruiting and retaining well-trained faculty from diverse social and intellectual backgrounds to teach in new, evolving and existing areas (also see Goal 6);
- e) developing faculty growth opportunities and reward structures that recognize good teaching; and
- f) strengthening the development and utilization of new technologies and methodologies that enhance instructional quality, creativity, collaboration and efficiency.

Universities have a moral obligation to look after the rights of future generations. To fulfill this obligation, universities need to define the current global interdisciplinary predicament and its resolution and to educate and motivate tomorrow's leaders to be able and willing to apply this knowledge to safeguard posterity.

Russell W. Peterson

◆ **Recommendation 2.1 Relate Agriculture and Natural Resources to General Educational Goals**

Faculty and colleges of agriculture and natural resources should provide students seeking a broad general education with curricular opportunities that reflect the rich diversity of traditional and emerging disciplines in agriculture and natural resources.

Students need to develop a general understanding of specialized scientific knowledge as well as perspectives offered by social, historical, ethical, and philosophical disciplines. Communication abilities and aesthetic appreciation are at the heart of a general education and general public literacy. Literacy implies that individuals are equipped with both the knowledge and the cognitive skill that enable them to make rational decisions relating to their lives, adapt to change, take charge of lifelong learning and participate in the civic responsibilities of a democratic society. Both students and faculty in agriculture and natural resources are encouraged to examine and apply the values and experiences provided by general education courses. In a world which is becoming increasingly interrelated and interdependent, knowledge of other languages, cultures and modes of thinking should be strongly encouraged.

In a similar manner, agricultural and natural resource faculty and staff have a great deal to offer to other disciplines in the university system. Within the diversity of disciplines supporting traditional and emerging needs of agriculture and natural resource management is a richness of knowledge and research that will impact on the future welfare of all citizens of the globe. It is important that faculty of colleges of agriculture and natural resources in the UW System be prepared to share more broadly both knowledge of their disciplines and their insights of how the specialized knowledge interrelates with that from other disciplines to provide solutions to increasingly complex problems.

We do not question whether our curricula should be revised and revitalized; we accept as given that they should be if our colleges are to remain the principle sources of highly educated leaders.

Keith Wharton
National Curriculum
Revitalization Conference

It is also essential that all students become aware of the major agricultural and natural resource issues that will impact their lives. College courses should be developed to deal with the breadth and quality of agriculture and natural resource topics for all students seeking a general education. Such courses offered by Agriculture and Natural Resources faculty, could contribute to programs of study in the humanities, social sciences, natural sciences and engineering, and provide a context for students who must become interested in and concerned about both the human and natural environments. These courses could be offered on an intercollege and/or interinstitutional basis.

In order to meet the goal of contributing to a better educated general citizenry, faculty in agriculture and natural resources should be prepared to:

- a) participate in the development and offering of curricula that reflects the importance of the agricultural and natural resource disciplines in global ecology and management;
- b) provide opportunities to undergraduate students interested in the social and natural sciences to have research experience with faculty;
- c) provide special opportunities for undergraduates majoring in K-12 education (preservice teachers) to participate in courses or research projects that will give them an enriched background of experience from which to initiate their teaching; and
- d) provide special opportunities for teachers (inservice) to participate in science curricula and research projects that will enrich the background from which they teach.

Resource education is very important and can start at the elementary age. We must teach our children about the interrelationships between water and the land so that we develop future leaders who are sensitive to these issues.

John L. Needy
FOCUS ON THE FUTURE

◆ Recommendation 2.2 Pursue a Broad-Based and Dynamic Curriculum

Pursue programs of instruction in agriculture and natural resources that are broad and global in scope, contemporary in focus, up-to-date in content, and accessible to the student population generally.

The future for well-trained students of agriculture and natural resources is bright. Demand is strong in relation to current and anticipated numbers of graduates. To be competitive in the future, graduates of colleges of agriculture and natural resources will need both a broad general education in the traditional liberal arts and well-focused coursework in a major with opportunities for internships, practicums and exchange programs.

These expectations may necessitate rethinking the balance in the distribution of requirements for bachelor level training and perhaps the creation of some more broadly-focused masters programs. Multidisciplinary, cross-college and intercampus programs may need to be created and nurtured. Some institutions may try new organizational arrangements.

Consideration should be given to assessing students' knowledge base and learning skills when they enter agriculture and natural resource programs. Programs of study can then be tailored to help students develop the range of general competencies of an educated person, the characteristics desired of agricultural or natural resource professionals, and the knowledge of how to continue learning throughout one's lifetime.

Included in the curricula of colleges of agriculture and natural resources must be study of social institutions and cultures. The curriculum should also include the study of resource development and ecosystem management, public policy development and policy implications, technology and its implications, agricultural management and marketing, human health and nutrition, and rural and urban landscapes. These topics in combination with the more traditional areas of plants and animals, soil and water, and land and capital, can provide curricular and co-curricular programs that prepare agriculture and natural resource professionals who:

- a) understand and utilize the scientific approach, can evaluate information, and can create and assess alternative solutions;
- b) ask value questions and appreciate a value perspective in others; and
- c) are intellectually curious and have a commitment to learning as an open ended process.

How many college of agriculture graduates know a second language? How many know the culture or some consumer preferences in China, India, Nigeria, or Indonesia—four of the five most populous countries of the world? Or of Japan, South Africa, Germany, France, or England, among the highest income countries of the world?

Duane Acker

If I were designing a curriculum for agriculturalists graduating in 2020, I would include coursework in macroeconomics, development economics and international trade. . . I would require students to become more attuned to other cultures. The economy is global, agribusiness is global, agricultural markets are global. Agriculturalists who do not understand languages, and do not appreciate cultural differences in tastes and behavior will be ill-equipped to face this global environment.

M. Ann Tutwiler

Consistent with the globalization of agricultural and natural resource issues, the recognition that our social institutions must become more diverse, and the knowledge of the interdependency between current and future generations must also enable students to:

- a) develop a global perspective;
- b) appreciate cultural diversity;
- c) understand the concept of stewardship;
- d) experience cross-college courses on contemporary agricultural and natural resource issues; and
- e) participate in capstone courses that bring together the natural, physical and social sciences.

In an environment of rapid scientific and technological advances and shifting issues, faculty have an absolute need for continuing education. If these ideas on how to more effectively train agriculture and natural resource students are to be implemented and tested, it will be imperative for faculty to have increased support for professional development opportunities. This support should include funding for sabbaticals, released time to attend professional meetings, and resources to support a semester or summer at another campus, a state agency, or with a private firm. In addition, the current faculty evaluation and reward system does not adequately support innovative teaching. It will need to be revamped to do so.

◆ Recommendation 2.3 Enhance Independent Learning and Leadership

Deliver programs of instruction in agriculture and natural resources in a manner that maximizes independent learning and provide extracurricular activities that develop leadership.

A recurrent theme of agriculture and natural resource clients—students, alumni and employers—has been the importance of communication, networking, teamwork, critical thinking, technological and analytical skills. It is generally recognized that these skills are enhanced by undergraduate internships in the private sector or in local or state agencies, memberships and service as officers of student organizations, and participation in regional and national competitions in their field of study. These activities are a hallmark of UW System colleges of agriculture and natural resources.

As we enter the 1990s, other opportunities need to be created, expanded and/or refined to help future agriculture and natural resource students develop independent learning skills. These include participation as:

- a) junior colleagues in faculty research projects,
- b) exchange students on other campuses, and
- c) members of international agriculture and natural resource seminars, exchange programs or applied research projects.

Across the country, a variety of issues related to effective learning are being discussed and tested. New questions have been raised about learning environments. New educational technology is available. A consensus is emerging that multidisciplinary and multifaceted approaches to problem solving are essential, and renewed attention has been given to the central role of value questions in education. Each of these trends has implications for agriculture and natural resource education. Among these implications are:

- a) Ongoing research on learning environments finds cultural variation in optimal learning styles while pointing to a need for more participatory and collaborative approaches in the classroom.
- b) Telecommunications and computer technology provide opportunities for efficiently and effectively interacting directly from the classroom with universities, agribusinesses, state agencies, government and public organizations.

One of the major tasks facing higher education in the food and agricultural sciences will be the responsibility to teach students to synthesize what they have learned. Increasingly, students will have to connect different modes of analysis and integrate bodies of thought to illuminate issues of human importance.

Curricular Innovation for 2005

The issue of developing effective leadership and decision making capacity is at the heart of what the Midwest group has defined as the major rural development problem facing the region.

Daniel Otto,
FOCUS ON THE FUTURE

c) Problems of air and water quality, agricultural and agroforestry profitability and sustainability, food safety and human nutrition, food marketing and international trade, rural youth and rural elderly, to name a few, all call for specialists from a number of traditional disciplines to collaborate in research and teaching.

d) Addressing value questions in a manner that captures both the breadth of perspectives and the complexity of such questions demands clarity of analysis and the ability to simplify without becoming simplistic.

Goal 3

Serve a Broader Public from an Expanded Knowledge Base

Strategies

Commitment to rededicate the faculty, staff, administrators, and students to the ideals, tradition, and practice of the Wisconsin Idea.



Recommendation 3.1 Offer Integrated, Problem Solving Extension Education

Deliver holistic, balanced, problem solving education and lifelong learning opportunities to the citizenry in a timely manner.

The pursuit of excellence in extension and continuing education involves rededication to providing equality of access to knowledge to all residents utilizing all UW System faculty and academic staff including those not funded explicitly for extension purposes. To increase efficiency of faculty resources and timeliness of the knowledge extended, new technologies should be explored and evaluated to expand and improve upon information delivery methods.

To responsibly transfer knowledge to the citizens of the state, extension programs must pursue excellence by:

- a) integrating strategies directed at improving profitability and marketing with health, environmental stewardship and socio-economic viability of communities;
- b) helping individuals and communities focus on long-term implications of all decisions rather than only on short-term expediences;
- c) providing problem solving education in a broadly encompassing context to help individuals and communities understand how knowledge contributes to the complete person and to a sustainable community;
- d) articulating and transferring research-based knowledge to agriculture and natural resource clients directly or to information wholesalers in the private sector who transfer information to clients;
- e) facilitating alternative venues for the delivery of lifelong learning opportunities; and
- f) defining an incentive and reward system that makes clear to all faculty the expectation for public service.

***To be successful in the future,
Extension must decide to lead
and then to do so with a vision
and a boldness.***

Dale Lick
Extension in Transition:
Bridging the Gap Between
Vision and Reality

Think of education when you think of rural development. It is the only thing that will bring us from one generation of poverty to the next generation of opportunity.

The Hon. Guy Hunt,
Governor of Alabama
FOCUS ON THE FUTURE

American higher education emphasizes excellence with utility. In this model, science is applied to topics of relevance to society. Over time, the range of topics considered relevant for scientific research expands. Consequently, the extension education curriculum must also be broadened.

But the extension system faces some great challenges. The information needs of Wisconsin's nearly five million citizens and their complex businesses are both wide ranging and sophisticated. For example, addressing resource management issues and local government education needs require county extension faculty with broad and balanced training; but, the generalist agricultural extension agent often can't meet the needs of the advanced, specialized producer or business person. Greater specialization at the county level is desirable. The limited numbers of extension faculty, even when augmented by the outreach activity of research and instructional faculty, cannot adequately interact with the millions of potential information "consumers" through traditional approaches. New approaches and new communication technologies are needed urgently.

Areas of concern to the extension curriculum include agri-business management, natural resource protection and management as well as natural resource development, public policy, rural family and community issues, rural revitalization, global issues affecting agricultural markets and rural peoples, nutrition, food safety, risk assessment, biotechnology and genetically-altered organisms. The curriculum needs to give special emphasis to:

- a) understanding scientific approaches and outcomes,
- b) developing critical thinking and analytical skills,
- c) facilitating informed participation in public policy debates and the management of public resources, and
- d) developing methods to effectively communicate research findings to a diverse public and incorporating client feedback to refine those methods.

Natural resource management and food safety are two current high priority extension issues that illustrate the relevance of these guidelines. Helping the citizenry understand the changing demographics and changing preferences in the use of natural resources, and the economic importance of natural resources and the development of their value-added products can be vital to the state's economy. A more complex issue is policy education for publicly owned natural resources. In the food area, the immediate task is to provide risk assessment and risk management education to deal with chemicals in the environment and the promotion/regulation of other technologies.

To serve a broader public and to maintain and enhance the quality of that service, UW System programs in agriculture and natural resources will need to:

- a) establish ways to systematically involve citizens and organizations, public officials and businesses in their program planning;
- b) use modern communication and information transfer technology to assure full utilization of and access to faculty expertise;
- c) expand programs directed at professionals and private service delivery networks to maximize multiplier effects;
- d) ensure that Wisconsin citizens receive the full benefit from functionally integrated and coordinated extension and vocational technical programs;
- e) provide funds and encouragement for increased educational opportunities and sabbaticals to keep faculty on the cutting edge of research and technological, environmental, governmental, regulatory, and social issues; and
- f) bridge local information needs with broadly trained county extension agents in cooperation with specialists with regional responsibility who share their expertise across clusters of counties.

We must educate and train the citizens of the state, not just during the 4-5 years of residence in a dormitory, but over a life-time.

James J. Zuiches

The thinking process that guides curriculum, extension and research endeavors should quite often block out "the current way of doing things" or "the current way of looking at things."

Duane Acker

Like the instructional curriculum, the extension curriculum depends on research, and, if working properly, helps guide attention to new research needs. Public education generates new research questions, reveals a need for new data bases, and presents new techniques requiring refinement and evaluation.

Questions identified by the public, may, in turn, necessitate the development of alliances with other parts of the university and other state agencies, such as the medical schools on nutritional and health issues; natural resource and agriculture departments on farm chemicals and water quality issues; and business schools or recreation and tourism departments on rural development planning.

Goal 4

Provide Integrated, Holistic, and Anticipatory Educational Service to Wisconsin

Strategies

Commitment to ensure that the UW System is responsive to macro issues and nurtures those scholars capable and willing to transcend disciplinary boundaries and address these issues.

◆ Recommendation 4.1 Create Mechanisms to Address Comprehensive Issues

Establish mechanisms to bring together scholars whose primary interest is to identify and address major agriculture and natural resource issues in an interdisciplinary and interinstitutional way.

Departmental and disciplinary loyalty have historically inhibited interdisciplinary research, instruction, and outreach. Departments are often protective of their perceived intellectual domains. Graduate school strongly socializes new faculty in narrow specialities within a single discipline and promotion, tenure, and salary increases are determined by peers in the department or disciplinary groups. Typically, departments place the highest value on contributions to the discipline.

In addition to disciplinary pressures, availability of federal research funds tend to set the research agenda. Researchers naturally respond to the availability of funds, and often assume that the sponsor's priorities reflect societal need. Local or state needs may not be addressed by the traditional research funding institutions and agencies.

The result of these combined pressures is highly focused research that often serves the profession or branch of science more than Wisconsin or society generally.

Thus, there is a need to create mechanisms to identify and address broad issues in an interdisciplinary and interinstitutional way. Efforts must be made to find ways to engage faculty, staff, and students from a single campus and/or from a number of campuses in interdisciplinary study of important, emerging issues. Sources of funding for these interdisciplinary efforts must be developed for the studies to be undertaken.

The culture of scientific achievement on campus is firmly embedded in individual investigator research. Collaboration among biological and physical scientists in related fields has produced important breakthroughs, and is not uncommon. But effective collaboration across unrelated disciplines—particularly among biological and social scientists—appears regrettably rare. The ability of faculty to work across college boundaries is even more limited.

Charles Benbrook

Insufficient numbers of young scientists are pursuing careers in interdisciplinary or systems research. This is in part because higher education, peer review, the agricultural research systems, and their funding sources tend to encourage narrow intradisciplinary research over interdisciplinary work. As a result, agricultural scientists often lack the skills and insights to understand fully on-farm problems or how farmers can most readily overcome them.

National Research Council
ALTERNATIVE AGRICULTURE

◆ **Recommendation 4.2 Formulate Reward and Evaluation System for Interdisciplinary Faculty**

Develop and implement appropriate standards for rewarding interdisciplinary participation and productivity.

Faculty who practice interdisciplinary approaches receive less support from traditional disciplines. Not only do interdisciplinary faculty need a supportive structure, they also must be evaluated and rewarded on the basis of their interdisciplinary contributions. Intrinsic rewards that come from the challenge of working with complex systems and the knowledge of providing direct service to the citizens are not enough. The challenge is to create structures and mechanisms for recognizing and rewarding excellence, and to assure a secure environment in which to develop interdisciplinary approaches to intellectual understanding and problem solving. It must be remembered, however, that interdisciplinary efforts should not come at the expense of dismantling disciplinary competence. Interdisciplinary efforts can make their contributions to scientific understanding only if there is a strong disciplinary base.

Evaluation of interdisciplinary research, instruction, and outreach remains elusive. Resource issues span the disciplines and their complexity demands interdisciplinary work and its evaluation. Consequently, new standards of assessment must be developed.

◆ Recommendation 4.3 Build Upon Past Interdisciplinary Experience

Review operational style and contributions to knowledge and public service of successful interdisciplinary centers, and incorporate the knowledge gained into the organization and operation of evolving interdisciplinary centers.

In an attempt to be responsive to major issues, multidisciplinary centers have been created. Indeed, interdisciplinary research, instruction, and extension programs have a long history with mixed success. A barrier to success has been the failure to develop the scope and productivity expected because:

- a) the long-term financial future of interdisciplinary centers often remain uncertain and without strong institutional backing;
- b) faculty and staff view the problem from several multidisciplinary perspectives but do not evolve into a team that blend disciplinary perspectives into an *interdisciplinary* approach;
- c) the centers provide no long term security and status; or
- d) long-term missions for the centers are not articulated.

Since the UW System has several interdisciplinary centers based on alternative institutional structures and reward systems, a thoughtful review of successful centers would strengthen frameworks for future interdisciplinary activities.

Only through integration will an academic base for sustainability be created, and then only if it becomes a university-level theme.

John C. Gordon

Strengthen and Augment Collaborative Approaches

Strategies

Only by attracting and educating people capable of integration on a grand scale, who are at the same time practical and client driven, can universities do their part in sustaining the human enterprise. .. Do we have the institutional will to follow it?

John C. Gordon

Commitment to the development of strong linkages with agriculture and natural resource programs at public universities in neighboring states, among colleges, schools, and programs of different UW System institutions, and with state agencies and the private sector.

◆ Recommendation 5.1 Expand Regional Cooperation

Establish a network of upper midwest public institutions with programs in agriculture and natural resources in order to improve research, extension, and instructional capacity.

We face the beginning of a new century with increased competition for limited resources. The diversity, complexity and magnitude of issues confronting agriculture and natural resources require that higher education make choices among areas of expertise in order to emphasize, build, and maintain appropriate institutional infrastructure and faculty strength.

If single states can no longer afford to maintain both breadth and depth in all the principal scientific areas that agriculture and natural resources require, regional approaches are an alternative. Indeed, collaboration in instruction, research, and extension may be essential to the maintenance of a critical mass of experts able to engage in interdisciplinary problem solving on a range of agricultural commodities and natural resources questions as well as on basic and applied regional agriculture and natural resource issues. In any event, the pressure for identification and funding of priority areas will become increasingly urgent.

A network of regional cooperation can be built on some successful pilot projects. For example, several midwest universities have joined forces to establish and support satellite communications among campuses. Such joint sponsorship will allow collaborative instructional programs to be developed at and offered from one campus and received by another. Wisconsin's county extension offices are connected via satellite downlinks to land grant and other campuses across the nation. Intercampus and interstate instruction and extension programs will be facilitated by telecommunication technology. For nearly 30 years, six land grant universities in the midwest have worked together on international agricultural projects through the Midwest Universities Consortium on International Activities (MUCIA).

In addition, collaborative interstate research projects are underway. Maintaining excellence in science is costly, and costs are soaring. Research projects that involve faculty from various universities can control long-term costs while developing a critical mass of expertise that can be tapped to meet regional needs. Linkage of the agricultural experiment stations of two or more North Central region institutions has been one effective way to bring research expertise from several universities to bear on common problems.

At present, 168 north central regional research and extension committees exist and 60 cooperative projects are underway. To facilitate further regional specialization and cooperation, the UW System should formalize relations with public universities in Iowa, Illinois, Michigan, and Minnesota offering degree granting programs in agriculture and natural resources. Appointment of a 5-8 person committee to establish mechanisms for implementation of regional cooperation in research, instruction, and extension is needed. Top priority should be given to:

- a) increasing areas of research collaboration and complementarity, and
- b) initiating and expanding exchange and, possibly, sharing of instructional, research, and extension faculty and information.

We must use the past as a guideline, not as a place to dwell. We must communicate in a strong, clear fashion and we must work together.

Kaye Bratten
FOCUS ON THE FUTURE

All the sciences and arts are taught as though they were separate. They are separate only in the classroom. Step out on the campus and they are immediately fused.

Aldo Leopold

◆ **Recommendation 5.2 Strengthen Interinstitutional Cooperation among UW System Campuses**

Strengthen and expand UW System collaborative arrangements for research in agriculture and natural resources and its application through extension.

In order to meet the need to more efficiently bring together the critical mass of agricultural and natural resource expertise in the UW System, the UW System Board of Regents established the UW System Consortium for Extension and Research in Agriculture and Natural Resources in 1976. This consortium has provided an opportunity for faculty from four UW System institutions to work collaboratively, connecting applied research important to agriculture and natural resources with basic science and other faculty from UW-Madison. The arrangement has strengthened the interactive basic-applied science continuum, underwritten over 100 applied research projects, benefited classroom teaching, provided support for graduate student research, and helped launch a rural leadership program. The Consortium provides a strong basis for collaboration and has evolved a workable structure and process.

However since the Consortium was established, the scope of the issues has expanded. Competing demands for state and federal resources and an exceptionally strong academic market spurred by large numbers of faculty reaching retirement, produce new demands for innovative ways to organize new combinations of experts. While the research mission, resources and expertise on these issues is concentrated in doctoral-granting institutions of the UW System, research expertise within the UW System is certainly not limited to those institutions. To efficiently tap the creative energy and expertise needed to study a broad set of basic and applied research questions in agriculture and natural resources, consideration should be given to the kind of boundaries that should be placed on those who can participate in that research.

To meet the recognized expanding need for broad, comprehensive, problem-focused, interdisciplinary research efforts, new programs should be developed to include projects that bring together the expertise of social, biological and physical scientists around current issues. For example, during the decade of the 1990s, acid rain, global climate change, air and water quality, biotechnology, production efficiency, nutrition and food safety, multiple use of resources including tourism, ecosystem management, forest and farm sustainability, and restoration of altered ecosystems are some of the topics that are of major concern.

Interinstitutional programs in agriculture and natural resources should:

- 1) identify high priority issues and problem areas;
- 2) attract appropriate faculty into research addressing these areas;
and
- 3) provide coordination of these research projects by linking investigators and avoiding duplication.

To augment learning and teaching opportunities for faculty, staff and students working in these new projects, the programs should create a variety of activities such as:

- a) faculty, staff and student intercampus exchanges,
- b) faculty exchanges that provide professional development opportunities;
- c) projects that develop new instructional materials based on emerging scientific knowledge; and
- d) projects with defined opportunities for graduate students to participate in exchanges.

We are shrunk into one community with a common fate. . . . Everyone is aware of that situation, but only a few act accordingly.

Albert Einstein

◆ Recommendation 5.3 Cooperate with State Agencies and the Private Sector

Improve mechanisms that encourage and expand joint policy development, research and application programs with state agencies and the private sector on a sustained basis.

The primary goals of the university are to a) educate the citizens and professionals of tomorrow, b) pursue scientific inquiry furthering the foundation of knowledge and c) disseminate that knowledge to the general public and specific user groups. The private sector and state agencies apply knowledge to problem-solving, policy formulation and product development.

The university and state government have often teamed with the private sector to apply knowledge to agriculture and natural resource problems. Prime examples include reforestation of northern Wisconsin, re-establishment of fisheries in the Great Lakes, prairie restoration along highway corridors and the establishment of a Center for Integrated Agricultural Systems to study sustainable agriculture. Continued pursuit of knowledge and its transfer to problem solving situations through state agencies merits further effort. Actions thus far have been sporadic rather than sustained. Mechanisms should be explored by individual educators and state agencies that would facilitate sabbatical-type opportunities such as:

- a) exchange of personnel on short-term assignments;
- b) affiliate appointments for state agency personnel; and
- c) a scholarship program for state agency researchers and management staff to pursue advanced education and training while at the same time contributing to instruction, research and extension programs.

It is time to forge joint programs of more lasting benefit to Wisconsin's citizens.

Mutually beneficial linkages between academic scientists and the private sector should be encouraged. While it is necessary to protect the professional integrity of all parties involved, closer working relationships would enhance faster transfer of knowledge to problem-solving, provide forums for joint experiments, and further the integration of the educational system with the management of agriculture and natural resource systems. Arrangements ought to be examined for cooperatively involving private sector specialists and scientists in programs of the UWSystem.

The ultimate foundation of any rural economic development policy must be anchored in the development of human capital.

John W. Kohl
FOCUS ON THE FUTURE

Diversity by Design

Strategies

Commitment to recruit and retain women and minority faculty, staff, administrators, and students in colleges of agriculture and natural resources.

◆ Recommendation 6.1 Attract and Retain Women and Minority Faculty, Staff, and Administrators

Diversify the human resources of the colleges of agriculture and natural resources by giving high priority to recruitment of women and minorities for faculty, staff, and administrative positions.

Women and minorities historically, and even now, are significantly under-represented in the agriculture and natural resource professions, particularly in production agriculture and virtually all natural resource areas. While the particular composition of agriculture and natural resource professionals does not reflect the diverse nature of the people who have been engaged in agriculture, it does mirror a history of programs targeted along gender lines.

With time, the traditional sources of agriculture and natural resource professionals have declined relatively and absolutely. No longer are agricultural or rural people the exclusive caretakers of the rural landscape. Consequently, the old patterns of faculty, staff, and administrative recruitment for colleges of agriculture and natural resources should and must change. Of necessity, colleges of agriculture and natural resources must now seek faculty, staff, and administrators beyond the bounds of the traditional pool. This, in turn, means reassessing recruitment policies and procedures and conditions for retention, most notably the professional climate for a heterogeneous faculty.

For the future of agriculture and natural resource programs, it is imperative that their teachers, researchers, and leaders begin to reflect the diversity extant in the society generally and in agriculture and rural areas specifically. Moving quickly to promote minorities and women to faculty and administra-

When federally supported vocational agriculture education was created in 1917, about one-third of the U.S. population lived on farms. Farm businesses dominated rural life and sustained rural communities. Today, the U.S. farm population is about 2.2 percent of the overall population.

National Research Council
*Understanding Agriculture:
New Directions for Education*

The facts call us to action. By the year 2000, one third of our nation's population will be made up of Americans who are Black, Hispanic, American Indian or Asian/Pacific Islander. Twenty years later, non-white Americans will comprise 40 percent of the population. . . . Achieving diversity in higher education is an imperative that will directly affect our future economic well-being, our capacity to educate and govern in a truly democratic way and to create a cultural pluralism that celebrates difference.

James Sulton, Jr., UW System
ACHIEVING FACULTY DIVERSITY

tive positions will be important to the maintenance of both the quantity and quality of teachers and researchers in agriculture and natural resources in the future. The addition of women and minorities can provide diversity in research perspective and in the frameworks for addressing research questions. Faculty and administrative diversity is also vital for recruitment and retention of a diverse student body.

◆ **Recommendation 6.2 Recruit and Retain a Diverse Student Body**

Engage in special efforts to attract to programs of agriculture and natural resources minorities and women from a broad range of high school backgrounds and from the returning adult population, and in addition, males from metropolitan areas.

Consistent with the situation nationally, demand for agriculture and natural resource professionals is strong relative to the supply of graduates from colleges of agriculture and natural resources. Employers in the food, fiber, and forest industries, have and must turn to graduates of other programs to fill their labor force needs. Higher enrollments as recently as the late 1970s suggest that the most important limiting factor is interested students rather than capacity.

The traditional source of agriculture and natural resource students need not and should not be abandoned. However, with a decline in the number of young, white males from a farm background, it is imperative that colleges of agriculture and natural resources actively seek students from other gender, ethnic, and residential backgrounds and of a non-traditional age. Meeting the rapidly developing shortage of trained professionals necessitates bold action.

Special programs to identify women and minorities from urban and rural areas along with urban males should already be in formative or experimental stages. The scope of targeting potential students should be as broad as the modern concepts of agriculture and natural resources. Urban high school and technical programs with strong agricultural and environmental curricula will be important new allies in identifying interested and talented students. For recruitment and retention, the importance of women and minority faculty and staff as role models must be recognized.

At the same time, alliances should be strengthened with the UW Centers to encourage interested students to pursue programs in colleges of agriculture and natural resources. Alliances should also be promoted with elementary and secondary schools to familiarize students with the diversity of career opportunities in agriculture and natural resource fields.

Recruitment and retention of students, including women and minorities from urban and rural areas, depend on well-targeted recruitment and retention programs; high quality curriculum creatively delivered by a diverse faculty and staff; and periodic assessment of the array of academic programs needed to meet demands for a changing set of specialties.

Over the last twenty years, the American workplace has been changed by the entry of women into influential jobs. . . . Women make up 45% of the work force today compared with 38% in 1970. By 2000, expectations are that women will represent almost half the labor force.

Mary E. Heltsley

Goal 7

Implementation, Flexibility, and Planning

Strategies

Commitment to study change in resource systems and adapt programs to a dynamic and uncertain world.

Developing ways to meet emerging aspirations of students while also responding to the many challenges that lie ahead will keep things lively within the university system for many decades to come.

Charles Benbrook

◆ **Recommendation 7.1 Evaluate Progress and Monitor Change**

Encourage the UW System Board of Regents to request a report on the progress made by the institutions in implementation of the recommendations contained herein.

If Wisconsin can't do it, who will?

Mark Lapping

The time for action in agriculture and natural resource education is now. The world is changing and our approach to education must likewise change through an on-going, evolutionary process. To be proactive and anticipate the future and to monitor changes recommended in this report in relation to evolving trends, the Board of Regents should request periodic reports on progress being made in the implementation of committee recommendations. A review process should be established to regularly evaluate the agriculture/natural resource programs; and administrative structures should be created to facilitate interdisciplinary and inter-campus curriculum, instruction, extension and research. In addition, a periodic and systematic evaluation of the structure and framework of the educational delivery system for agriculture and natural resources should be conducted to ensure that the UW System continues to make efficient and effective use of its human and financial resources.

The UW System Steering Committee for Strategic Planning for Agriculture and Natural Resources has invested considerable energy in and provided collective wisdom for the future of agriculture and natural resource programming. Too often, intense effort is invested in the preparation of a report and not in implementation and progress. The Committee desires to impress upon the UW System the urgency for action and the responsibility to monitor change in agriculture and natural resource education.

Endnote

This is our strategy for leadership and a blueprint for Wisconsin's tomorrow.

Footnotes

¹ As a key component for defining goals and strategies to meet the future needs of agriculture and natural resource education, the Steering Committee and the UW System Office of Academic Affairs conducted a conference entitled "Agriculture and Natural Resources Education for 2020." The conference, held at the Yahara Center in Madison, November 5-7, 1989, featured presentations from nine national leaders in agriculture, forestry, wildlife and environmental study, who provided their interpretations about the trends and issues facing agriculture and natural resource education. The presentations were followed by discussion with invited participants from Wisconsin education, government, agribusiness and industry.

² The common international axiom that frames the big issues is sustainable development. It is the notion that a society can satisfy its needs without degrading or contaminating the environment or depleting the resources on which future generations will also be dependent. While encompassing sustainable agriculture, the notion is much broader and includes changing patterns of energy and land use, water and air quality, and policy issues such as population growth, national debt, and income distribution within and among nations. At this stage in its development as a concept, the implications of sustainable development are:

- a) at the global level, the series of interlocking issues be dealt with concurrently, and
- b) at the local level, new processes and approaches for ecosystem management will need to be developed and public and private decisions will need to be made with the goal of sustainability in mind.

Wisconsin's efforts at developing integrated agricultural production systems is occurring within this context.

One difficult question may arise with increasing frequency. Can society's most pressing problems be traced to a lack of knowledge or a collective inability to fully or effectively use existing knowledge?

Charles Benbrook

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Appendix 1

Meetings of the the UW System Steering Committee
for Strategic Planning for Agriculture and Natural ResourcesJune 14, 1989
Van Hise Hall, MadisonMarch 1, 1990
Van Hise Hall, MadisonAugust 21, 1989
Van Hise Hall, MadisonApril 11-12, 1990
UW-PlattevilleOctober 2-3, 1989
UW-River FallsMay 30, 1990
Friedrick Center, MadisonDecember 18-19, 1989
Heritage Room, University
Center, UW-Stevens PointJune 13, 1990
Van Hise Hall, MadisonJanuary 25, 1990
Friedrick Center, MadisonJuly 25, 1990
Van Hise Hall, MadisonFebruary 13-14, 1990
Wisconsin Center, MadisonOctober 10, 1990
Van Hise Hall, MadisonNOVEMBER 5-7, 1989EDUCATION FOR 2020 CONFERENCE
Yahara Center, Madison

Appendix 2

AGRICULTURE AND NATURAL RESOURCES: EDUCATION FOR 2020

conference sponsored by
The University of Wisconsin System
 at the Yahara Center, Madison, WI
 November 5-7, 1989

CONFERENCE PRESENTATIONS:

Tapping the Full Potential of Wisconsin's Natural and Human Resources

Charles M. Benbrook, Executive Director Board on Agriculture,
 National Research Council, National Academy of Science

For 2020: Trends and Issues in Agricultural Production and Marketing

Duane Acker, Distinguished Professor Animal Science and Industry and President Emeritus,
 Kansas State University

It's in Someone Else's Backyard, So Why Worry? Rural Youth and Rural Families

Mary E. Heltsley, Dean, School of Home Economics, University of Minnesota

Forestry and the Environment: From Spare Time to Big Time

John C. Gordon, Dean, School of Forestry and Environmental Studies, Yale University

Land Use and Natural Resource Management

Mark B. Lapping, Professor, Regional and Community Planning, Kansas State University
 and Dean-designate, School of Planning & Public Policy, Rutgers University

Forces That Will Drive the International Economy into the Next Century

M. Ann Tutwiler, Associate Director, International Policy Council on Agriculture and Trade,
 Resources for the Future

The Viability of Rural Populations and Communities

James J. Zuiches, Director, Agricultural Research Center, Washington State University

The Biosphere, the University, and Future Generations

Russell W. Peterson, Vice-Chair, Better World Society; President, International Council for Bird
 Preservation; President Emeritus, National Audubon Society; Former Chair, President's Council on
 Environmental Quality and Former Governor of Delaware

APPENDIX 3: Table 1

University of Wisconsin-Madison
College of Agricultural and Life Sciences
Undergraduate Headcount Enrollment and Degrees By Major

Major	Fall Enrollments							BS Degrees Awarded					
	1984- 1985	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990	1990- 1991	1984- 1985	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990
Agricultural Business Management	74	62	69	66	46	48	38	13	10	3	13	12	8
Agricultural Economics	233	215	160	133	122	110	110	92	72	84	62	48	48
Agricultural Ed & Extension Ed	59	61	48	35	26	25	23	9	15	22	14	8	11
Agricultural Engineering	131	102	98	75	62	45	48	63	28	26	24	20	24
Agricultural Journalism	84	80	73	82	77	86	78	38	26	33	25	25	28
Agricultural Mechanics and Management	19	28	17	17	19	19	12	7	8	5	6	10	
Agronomy	51	51	50	35	35	23	20	20	22	12	21	11	9
Bacteriology	158	186	201	217	212	204	219	43	45	60	50	46	44
Biochemistry	118	143	143	157	159	155	148	23	18	28	17	25	26
Construction Administration	128	115	132	144	152	131	115		31	27	29	28	44
Dairy Science	163	158	125	102	97	91	75	42	30	40	35	28	29
Dietetics	92	92	71	80	69	68	55	26	28	20	18	17	15
Entomology	14	12	14	10	10	4	3	2	3	1	7	3	6
Food Science	91	88	77	88	78	60	55	27	35	23	23	27	20
Food Service Administration	13	14	10	12	12	11	5	3	5	2	4	4	5
Forest Science	50	41	38	31	23	38	39	14	8	7	6	9	7
Genetics	60	67	72	78	83	103	127	7	7	9	13	12	14
Horticulture	120	103	66	70	59	50	51	29	44	28	27	25	22
Landscape Architecture	130	140	154	162	169	165	172	36	30	26	25	25	31
Meat and Animal Science	173	143	135	113	84	74	62	47	26	32	28	27	23
Nutritional Sciences	41	46	43	48	40	30	35	9	10	7	10	7	8
Plant Pathology	9	15	16	9	9	5	2	3	5	3	5	2	5
Poultry Science	13	15	11	17	19	18	18	4	—	5	5	9	6
Recreation Resource Mangement	66	61	64	59	52	48	58	25	12	10	12	11	14
Rural Sociology	26	26	19	23	25	24	24	13	11	5	8	4	14
Soil Science	50	40	34	33	30	34	37	27	13	14	13	9	15
Wildlife Ecology	74	73	80	94	108	128	133	8	8	13	11	10	17
<u>Undecided</u>	<u>73</u>	<u>79</u>	<u>125</u>	<u>110</u>	<u>113</u>	<u>99</u>	<u>128</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
TOTAL	2,313	2,256	2,145	2,100	1,990	1,896	1,890	630	550	545	511	462	493

APPENDIX 3: Table 2

University of Wisconsin-Platteville
College of Agriculture
Undergraduate Headcount Enrollment and Degrees By Major

	Fall Enrollments							BS Degrees Awarded					
	1984- 1985	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990	1990- 1991	1984- 1985	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990
Major													
Agricultural Economics	29	26	26	22	23	18	14	15	2	6	6	6	4.5
Agribusiness	162	162	139	122	121	122	113	35	33	41	26	24	30
Agricultural Engineering Technology	58	48	40	36	32	43	52	12	14	10	12	4	6.5
Agricultural Education	37	35	37	30	23	21	21	13	4	7	7	3	5
Animal Science	72	92	69	55	57	57	65	15	17	12	9	16	6
Crop and Soil Science	52	48	53	38	32	32	46	13	11	8	9	6	8
Technical Agriculture	56	45	36	45	36	33	24	15	14	11	12	12	2
Undecided	17	14	18	20	18	18	19						
Pre-Vet (Nondegree Program)	29	17	9	16	16	23	31						
TOTAL	512	487	427	384	358	367	385	118	95	95	81	71	62

APPENDIX 3: Table 3

University of Wisconsin-River Falls
College of Agriculture
Undergraduate Headcount Enrollment and Degrees By Major

Major	Fall Enrollments						BS Degrees Awarded					
	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990	1990- 1991	1984- 1985	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990
Agricultural Broad Area (1)	209	206	228	224	228	195	32	28	33	33	35	28
Agricultural Business	210	189	148	135	106	119	34	37	40	35	34	25
Agricultural Economics	33	27	27	20	17	18	1	5	5	2	3	1
Agricultural Education	86	87	74	72	77	71	22	9	14	15	17	9
Agricultural Engineering Technician	76	65	54	55	55	60	18	11	10	14	6	9
Agricultural Marketing	13	16	12	14	5	11	5	5	4	5	4	2
Agronomy		17	15	21	24	21		12	6	1	4	5
Animal Science	392	373	318	307	262	246	52	58	55	65	53	56
Conservation	39	36	29	40	43	74	5	4	5	4	3	2
Earth Science Education	40	7	11	5	3	6	0	1	0	1	0	1
Farm Management	45	34	22	21	20	18	9	9	9	8	2	3
Food Science and Technology	47	56	59	51	57	44	11	9	8	17	6	18
Geology		37	23	34	28	35	9	6	6	7	9	4
Horticulture		46	52	46	40	46		6	6	8	11	6
Plant Science (2)	90						22	5			4	
Pre-Forestry	3	3	5	4	1	3						
Pre-Vet Medicine	182	137	98	96	102	125						
Science Land Management	39	37	29	34	32	51	16	13	11	6	8	
Soil Science	18	11	12	15	13	19	5	5	4	2	4	5
TOTAL (3)	1,522	1,384	1,216	1,194	1,113	1,162	241	223	216	223	203	176

(1) Includes students enrolled in Extended Degree Program, including (60) in 1985-86, (59) in 1986-87, (90) in 1987-88, (110) in 1988-89, and (100) in 1989-90.

(2) See Agronomy and Horticulture after 1985-86.

(3) This report does not include any of the unclassified students, some of whom will be declaring an agricultural major.

APPENDIX 3: Table 4

University of Wisconsin-Stevens Point
College of Natural Resources
Undergraduate Headcount Enrollment and Degrees By Major

Major	Fall Enrollments							BS Degrees Awarded					
	1984- 1985	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990	1990- 1991	1984- 1985	1985- 1986	1986- 1987	1987- 1988	1988- 1989	1989- 1990
FORESTRY TOTAL	530	475	422	356	283	250	223	114	105	82	76	83	52
Forestry	351	290	219	176	125	127	107	1	0	0	0	0	0
Forestry Administration	39	37	44	36	26	22	19	30	29	23	20	12	9
Forestry Management	55	56	59	43	42	25	31	46	37	31	23	33	18
Forestry Recreation	36	45	47	37	27	24	19	17	23	10	16	13	6
Forestry Urban	49	47	53	64	63	52	47	20	16	18	17	26	19
PAPER SCIENCE TOTAL	212	241	257	231	192	169	175	17	24	25	30	32	27
RESOURCE MANAGEMENT TOTAL	298	296	305	255	233	185	213	54	66	55	52	57	57
Resource Management		291	289	237	199	156	182		38	0	3	3	2
Environmental Education and Instruction		4	9	14	18	18	18		3	4	8	10	13
Land Use Planning		0	2	2	13	11	9			4	1	4	9
Youth and Camp Management		1	5	2	3		4		0	2	2	2	
Natural Resources, Undecided						71	98		25	45	38	38	32
SOIL SCIENCE TOTAL	53	41	24	30	41	31	32	15	14	8	2	10	8
WATER RESOURCES TOTAL	192	192	196	220	192	198	190	38	33	45	39	46	42
Chemistry	23	22	38	38	33	36	32	12	8	16	12	13	15
Fisheries	40	34	40	38	38	40	37	13	12	16	15	17	8
Limnology	3	6	3	8	12	7	9	2	3	1	2	3	4
Management	13	21	22	27	19	31	29	10	9	10	7	9	9
Water/Wastewater	0	2	11	12	17	16	17	0	1	2	3	4	6
Water Resources	113	107	82	97	73	68	66	1	0	0	0	0	0
WILDLIFE TOTAL	404	420	368	363	341	404	362	34	49	36	46	39	45
TOTAL	1,689	1,665	1,572	1,455	1,282	1,308	1,293	272	291	251	245	267	231